UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

January 13, 2000

MEMORANDUM

SUBJECT: Revised Acute and Chronic Dietary Exposure and Risk Analyses for Coumaphos (PC code 036501); DP Barcode D262058; Submission S573008; Case 818804.

FROM: Christina Jarvis, EPS
Sherrie L. Mason, Chemist
Reregistration Branch II
Health Effects Division (7509C)

THROUGH: Alan Nielsen, Branch Senior Scientist
Reregistration Branch II
Health Effects Division (7509C)

and

Tom Bloem and Dave Soderberg
Dietary Exposure Science Advisory Council (DE SAC)
Health Effects Division (7509C)

TO: Christina Jarvis, Risk Assessor
Reregistration Branch II
Health Effects Division (7509C)

Action Requested

Revised Tier 3 acute and chronic dietary exposure assessments were requested to determine the dietary risk estimates associated with the reregistration of coumaphos. There are no registered uses of coumaphos in/on food/feed crops; however, tolerances exist for residues in meat and milk. The revised Tier 3 dietary exposure assessments for coumaphos are highly refined and incorporate monitoring data for milk as well as percent livestock treated (%LT) for beef, milk, and pork commodities.

This memo has been reviewed and approved by the Health Effects Division's

Dietary Exposure Science Advisory Council.

Executive Summary

A refined acute and chronic dietary exposure assessments were conducted for the organophosphorus insecticide coumaphos, to determine the risks associated with uses of coumaphos for the control of arthropod pests on cattle, horses, and swine. Anticipated residues (ARs) were utilized to estimate the dietary exposure to coumaphos in the diets of the U.S. population, as well as certain sub-populations. Refinements to %LT information are incorporated into these assessments.

Acute risks associated with the use of coumaphos do not exceed HED's level of concern (>100% PAD[1]). The estimated acute dietary risk is 22% of the acute PAD at the 99.9th percentile for the most highly exposed sub-population, infants <1 year of age. Estimated chronic dietary risks associated with the use of coumaphos do not exceed HED's level of concern (>100% PAD[1]) for the most highly exposed sub-population, children 1-6 years of age. The chronic dietary risk for children 1-6 years of age is 13% of the chronic PAD.

Toxicological Information

On May 11, 1999, the Hazard Identification Assessment Review Committee (HIARC) met to discuss acute and chronic hazard endpoint selection for dietary exposure to coumaphos. The HIARC recommended to the FQPA Safety Factor Committee that the FQPA factor be removed in assessing the risk posed by coumaphos (N. Paquette memo, 5/12/99). In a meeting on May 17, 1999, the FQPA Safety Factor Committee accepted this recommendation, and the FQPA safety factor was removed (B. Tarplee memo, 06/01/99). Since the FQPA safety factor was removed (i.e., reduced to 1X), the acute and chronic PADs are equivalent to their respective RfDs.

The toxicology database for coumaphos is complete, and will support reregistration. Coumaphos is a Group E chemical, indicating that it is not likely to be carcinogenic in humans via relevant routes of exposure.

The following toxicology endpoints are used in the acute and chronic dietary risk assessment:

Table 1: Doses and Endpoints Selected for Acute and Chronic Dietary Risk Assessment

[1] PAD = Population Adjusted Dose = $\frac{\text{Acute or Chronic RfD}}{\text{FQPA Safety Factor}}$

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT
Acute Dietary	**LOAEL= 2.0 UF = 300 100X inter-and intraspecies extrapolation and 3X lack of NOAEL**	**Plasma ChE inhibition in females and RBC ChE Inhibition in both male and female rats**
	Acute RfD = 0.007 mg/kg/day aPAD = 0.007 mg/kg/day	
Chronic Dietary	**NOAEL=0.025 UF = 100 100X inter-and intraspecies extrapolation**	**Plasma and RBC ChE Inhibition in both male and female dogs**
		Chronic RfD = 0.0003 mg/kg/day
	Chronic RfD = 0.0003 mg/kg/day cPAD = 0.0003 mg/kg/day	

ChEI = Cholinesterase Inhibition.

Residue Information

The published tolerances for coumaphos are listed in 40 CFR §180.189. Tolerances are listed for:

Meat, fat, and meat byproducts of cattle, goats, hogs, horses, poultry and sheep 1.0 ppm
Milk-fat residues, reflecting negligible residues in milk 0.5 ppm
Eggs 0.1 ppm

No changes to the milk, cattle, horse, and hog tolerances are required. Although tolerances are still listed for poultry, eggs, goats, and sheep, the use of coumaphos on poultry and eggs has been canceled and the use of coumaphos on goat and sheep will be revoked. The acute and chronic Dietary Exposure Evaluation Model (DEEM™) analyses use the following anticipated residue values, calculated in a memo by M. Metzger, dated 7/18/89, with the exception of milk. The residue values used for milk are from the United States Department of Agriculture's (USDA's) Pesticide Data Program (PDP) 1997 and 1998 monitoring data which show no detectable residues in milk out of 750 samples tested. The residue data studies for coumaphos continue to be acceptable. The AR values calculated in the M. Metzger memo are still considered appropriate for dietary risk assessment purposes; however, all ARs should be re-evaluated in five years. The chronic AR for beef fat has been revised to 0.072 ppm from 0.15 ppm (C. Olinger memo, 3/7/95).

Table 2: Anticipated Residue Values for Use in Calculating Acute and Chronic Exposure

Commodity	%LT	Anticipated Residue (ppm)		
		Chronic	Acute	
Beef (and horse), lean meat without removable fat	5% beef only	0.03	RDF, 0.05	95 ZEROS 5 @ 0.05
Beef, fat	5%	0.072	RDF, 0.40	95 ZEROS 5 @ 0.40
Beef, liver (and meat by-products)	5%	0.10	RDF, 0.10	95 ZEROS 5 @ 0.10
Beef, kidney	5%	0.04	RDF, 0.04	95 ZEROS 5 @ 0.04
Hog, lean meat	1%	0.03	RDF, 0.20	99 ZEROS 1 @ 0.20
Hog, fat	1%	0.06	RDF, 0.60	99 ZEROS 1 @ 0.60
Hog, liver (and meat by-products)	1%	0.02	RDF, 0.02	99 ZEROS 1 @ 0.02
Hog, kidney	1%	0.02	RDF, 0.02	99 ZEROS 1 @ 0.02
Veal, lean meat without removable fat	100%	0.03	0.05	NA
Veal, fat	100%	0.072	0.40	NA
Veal, liver (and meat by-products)	100%	0.10	0.10	NA
Veal, kidney	100%	0.04	0.04	NA
Milk	4%	0.00064	RDF,0.016	720 ZEROS 30 @ 0.016

Note: Residue Data File (RDF).
The chronic milk anticipated residue incorporates the %LT.

Refinements using percent livestock treated information have been incorporated into the dietary exposure analyses for acute or chronic risk (i.e., personal communication with S. Smearman from the Biological and Economic Analysis Division, 12/9/99). The DEEM™ default concentration factors were used in both the acute and chronic analyses. Additional processing data (i.e. cooking and processing studies) would help to further refine the risk.

Essentially all beef consumed in the United States is cooked prior to consumption. An open literature study entitled "Effect of pH and Cooking Temperature on the Stability of Organophosphate Pesticides in Beef Muscle" (J. Agric. Food Chem. 1994, vol. 42, pages 2035-2039) shows that coumaphos decomposes under thermal conditions. Since nearly all meat products are cooked typically at temperatures similar to or higher than (and often for longer durations) than those used in this study, it seems likely that reduction of acute dietary exposure

to coumaphos would occur from cooking beef before consumption (S. DeVito memorandum dated 23/Nov./98).

Results and Discussion

The Tier 3 acute and chronic dietary exposure assessments were performed using DEEM™. DEEM™ is used to estimate exposure to constituents in foods comprising the diets of the U.S. population, including population subgroups. The software contains food consumption data from the U.S. Department of Agriculture Continuing Survey of Food Intake by Individuals (CFSII) from 1989-1992. A summary of the residue information used in the acute and chronic analyses is attached (Attachments 1 and 3 respectively).

Acute Exposure Analysis: (Tier 3)

The refined acute dietary risk analysis estimates the distribution of single day exposures for the overall U.S. population and certain subgroups and evaluates exposure to coumaphos for each food commodity. The calculated acute exposure (residue x consumption) was compared to an aPAD of 0.007 mg/kg/day, which reflects an FQPA factor of 1x. The results of the acute dietary analysis are attached (Attachment 2).

Table 3: Acute Dietary Risk Estimates

Population	(95th Percentile)		(99th Percentile)		(99.9th Percentile)	
	Exposure mg/kg/day	% aPAD	Exposure mg/kg/day	% aPAD	Exposure mg/kg/day	% aPAD
U.S. Population	0.000067	1%	0.000220	3%	0.000618	9%
All Infants (<1 year)	0.000046	1%	0.000241	3%	**0.001559**	**22%**
Children 1-6 years	0.000195	3%	0.000563	8%	0.001151	16%
Children 7-12 years	0.000123	2%	0.000322	5%	0.000626	9%
Females 13-50 years	0.000050	1%	0.000155	2%	0.000331	5%

Chronic Exposure Analysis: (Tier 3)

A refined chronic exposure analysis for coumaphos was performed utilizing the DEEM™ exposure modeling software. The input values include the anticipated residues incorporating %LT for commodities on which coumaphos is used. The results of the chronic dietary analysis are attached (Attachment 4).

Table 4: Chronic Dietary Risk Estimates

Population	Exposure	% Chronic PAD
U.S. Population	0.000013	5%
All Infants (<1 year)	0.000011	4%
Children 1-6 years	**0.000033**	**13%**
Children 7-12 years	0.000022	9%
Females 13-50 years	0.000009	4%

Conclusions

At the 99.9th percentile, the acute dietary risk estimates associated with the use of coumaphos do not exceed the HED's level of concern for any population subgroup. The acute dietary risk estimate for the highest exposed sub-population (infants <1 year) at the 99.9th percentile is 22% of the aPAD.

The chronic dietary risk estimates associated with the use of coumaphos do not exceed HED's level of concern for any population subgroup. The chronic dietary risk estimate for children 1-6 (the highest exposed sub-population) is 13% of the cPAD.

Attachments

Attachment 1: Residue Information (Acute)
Attachment 2: Results of Acute Dietary Exposure Analysis
Attachment 3: Residue Information (Chronic)
Attachment 4: Results of Chronic Dietary Exposure Analysis

cc: Sherrie L. Mason (RRB2), Coumaphos Reg. Std. File, Coumaphos Subject File, RF, LAN. RD/I: Dietary Exposure SAC (1/11/2000).

7509C: RRB2: S. Mason: CM#2:Rm 722B: 703-305-0563:1/13/2000.

Attachment 1

U.S. Environmental Protection Agency Ver. 6.78
DEEM Acute analysis for COUMAPHOS 1989-92 data
Residue file name: D:\Coumaphos\Acute\036501revac.R96 Adjust. #2 NOT used
Analysis Date 01-05-2000 Residue file dated: 01-03-2000/14:17:25/8
Reference dose: aRfD = 0.007 mg/kg bw/day NOEL = 2 mg/kg bw/day
Comment: All Livestock.

RDF indices and file names for Monte Carlo Analysis

1 BeefFat.rdf
2 BeefKdny.rdf
3 BeefLean.rdf
4 BeefLivr.rdf
5 milk.rdf
6 milk2.rdf
7 PorkFat.rdf
8 PorkLean.rdf
9 PorkLivr.rdf

Food Crop Grp	Food Name	RESIDUE (ppm)	RDF #	Adj.Factors #1	Code #2
318 D	Milk-nonfat solids	0.020000	5	1.000	1.000
319 D	Milk-fat solids	0.020000	5	1.000	1.000
320 D	Milk sugar (lactose)	0.020000	5	1.000	1.000
321 M	Beef-meat byproducts	0.100000	4	1.000	1.000
322 M	Beef-other organ meats	0.100000	4	1.000	1.000
323 M	Beef-dried	0.050000	3	1.920	1.000
324 M	Beef-fat w/o bones	0.400000	1	1.000	1.000
325 M	Beef-kidney	0.040000	2	1.000	1.000
326 M	Beef-liver	0.100000	4	1.000	1.000
327 M	Beef-lean (fat/free) w/o bones	0.050000	3	1.000	1.000
334 M	Horsemeat	0.050000	0	1.000	1.000
342 M	Pork-meat byproducts	0.020000	9	1.000	1.000
343 M	Pork-other organ meats	0.020000	9	1.000	1.000
344 M	Pork-fat w/o bone	0.600000	6	1.000	1.000
345 M	Pork-kidney	0.020000	9	1.000	1.000
346 M	Pork-liver	0.020000	9	1.000	1.000
347 M	Pork-lean (fat free) w/o bone	0.200000	8	1.000	1.000
398 D	Milk-based water	0.020000	5	1.000	1.000
424 M	Veal-fat w/o bones	0.400000	0	1.000	1.000
425 M	Veal-lean (fat free) w/o bones	0.050000	0	1.000	1.000
426 M	Veal-kidney	0.040000	0	1.000	1.000
427 M	Veal-liver	0.100000	0	1.000	1.000
428 M	Veal-other organ meats	0.100000	0	1.000	1.000
429 M	Veal-dried	0.050000	0	1.920	1.000
430 M	Veal-meat byproducts	0.100000	0	1.000	1.000

Attachment 2

U.S. Environmental Protection Agency Ver. 6.78
DEEM ACUTE analysis for COUMAPHOS (1989-92 data)
Residue file: 036501revac.R96 Adjustment factor #2 NOT used.
Analysis Date: 12-15-1999/10:44:26 Residue file dated: 12-09-1999/13:51:01/8
Acute Reference Dose (aRfD) = 0.007000 mg/kg body-wt/day
NOEL (Acute) = 2.000000 mg/kg body-wt/day
MC iterations = 1000 MC list in residue file MC seed = 1
Run Comment: All Livestock.

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Summary calculations:

	95th Percentile			99th Percentile			99.9th Percentile		
	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE
U.S. pop - all seasons:	0.000067	0.95	30011	0.000220	3.15	9077	0.000618	8.82	3238
All infants (<1 year):	0.000046	0.66	43443	0.000241	3.44	8313	0.001559	22.28	1282
Children (1-6 years):	0.000195	2.79	10234	0.000563	8.04	3555	0.001151	16.44	1737
Children (7-12 years):	0.000123	1.75	16314	0.000322	4.60	6217	0.000626	8.95	3193
Females (13+/preg/not nsg):	0.000060	0.86	33278	0.000180	2.57	11109	0.000297	4.24	6737
Females (13+/nursing):	0.000047	0.68	42254	0.000153	2.19	13058	0.000382	5.45	5237
Females (13-19 yrs/np/nn):	0.000065	0.93	30836	0.000184	2.63	10854	0.000411	5.88	4862
Females (20+ years/np/nn):	0.000045	0.65	44003	0.000143	2.04	14025	0.000296	4.23	6761
Females (13-50 years):	0.000050	0.71	40185	0.000155	2.22	12865	0.000331	4.72	6048
Males (13-19 years):	0.000090	1.28	22253	0.000224	3.20	8921	0.000416	5.94	4813
Males (20+ years):	0.000059	0.85	33797	0.000161	2.30	12401	0.000359	5.12	5576
Seniors (55+):	0.000049	0.70	40907	0.000142	2.03	14055	0.000299	4.28	6679

Attachment 3

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for COUMAPHOS 1989-92 data
Residue file: D:\Coumaphos\Chronic\036501revcr.R96 Adjust. #2 NOT used
Analysis Date 12-15-1999 Residue file dated: 12-15-1999/08:58:44/8
Reference dose (RfD) = 0.00025 mg/kg bw/day
Comment:All Livestock.

Food Crop Code	Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	#2
318	D	Milk-nonfat solids	0.000640	1.000	1.000
319	D	Milk-fat solids	0.000640	1.000	1.000
320	D	Milk sugar (lactose)	0.000640	1.000	1.000
321	M	Beef-meat byproducts	0.100000	0.050	1.000
322	M	Beef-other organ meats	0.100000	0.050	1.000
323	M	Beef-dried	0.030000	0.096	1.000
324	M	Beef-fat w/o bones	0.072000	0.050	1.000
325	M	Beef-kidney	0.040000	0.050	1.000
326	M	Beef-liver	0.100000	0.050	1.000
327	M	Beef-lean (fat/free) w/o bones	0.030000	0.050	1.000
334	M	Horsemeat	0.030000	1.000	1.000
342	M	Pork-meat byproducts	0.020000	0.010	1.000
343	M	Pork-other organ meats	0.020000	0.010	1.000
344	M	Pork-fat w/o bone	0.060000	1.000	1.000
345	M	Pork-kidney	0.020000	0.010	1.000
346	M	Pork-liver	0.020000	0.010	1.000
347	M	Pork-lean (fat free) w/o bone	0.030000	0.010	1.000
398	D	Milk-based water	0.000640	1.000	1.000
424	M	Veal-fat w/o bones	0.072000	1.000	1.000
425	M	Veal-lean (fat free) w/o bones	0.030000	1.000	1.000
426	M	Veal-kidney	0.040000	1.000	1.000
427	M	Veal-liver	0.100000	1.000	1.000
428	M	Veal-other organ meats	0.100000	1.000	1.000
429	M	Veal-dried	0.030000	1.920	1.000
430	M	Veal-meat byproducts	0.100000	1.000	1.000

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for COUMAPHOS (1989-92 data)
Residue file name: D:\Coumaphos\Chronic\036501revcr.R96
Adjustment factor #2 NOT used.
Analysis Date 12-15-1999/09:06:37 Residue file dated: 12-15-1999/08:58:44/8
Reference dose (RfD, CHRONIC) = .00025 mg/kg bw/day
COMMENT 1: All Livestock.

Total exposure by population subgroup

Population Subgroup	Total Exposure mg/kg body wt/day	Percent of Rfd
U.S. Population (total)	0.000013	5.3%
U.S. Population (spring season)	0.000013	5.1%
U.S. Population (summer season)	0.000013	5.4%
U.S. Population (autumn season)	0.000013	5.3%
U.S. Population (winter season)	0.000014	5.5%
Northeast region	0.000013	5.0%
Midwest region	0.000014	5.6%
Southern region	0.000014	5.7%
Western region	0.000012	4.6%
Hispanics	0.000014	5.6%
Non-hispanic whites	0.000013	5.2%
Non-hispanic blacks	0.000015	6.1%
Non-hisp/non-white/non-black)	0.000013	5.0%
All infants (< 1 year)	0.000011	4.3%
Nursing infants	0.000004	1.5%
Non-nursing infants	0.000014	5.4%
Children 1-6 yrs	0.000033	13.2%
Children 7-12 yrs	0.000022	8.9%
Females 13-19(not preg or nursing)	0.000012	4.9%
Females 20+ (not preg or nursing)	0.000008	3.3%
Females 13-50 yrs	0.000009	3.7%
Females 13+ (preg/not nursing)	0.000010	4.2%
Females 13+ (nursing)	0.000011	4.5%
Males 13-19 yrs	0.000015	5.9%
Males 20+ yrs	0.000011	4.3%

Seniors 55+	0.000009	3.5%
Pacific Region	0.000011	4.6%
